WHAT WE CLAIM ARE:

1. A method of manufacturing a semiconductor device, comprising the steps of:

covering a surface of an insulating film made of silicon-containing insulating material with a mask pattern; and

dry-etching the insulating film by using the mask pattern as a mask and etching gas which contains C_4F_8 gas and C_xF_y gas (wherein x and y are an integer and satisfy $x \geq 5$ and $y \leq (2x - 1)$.

2. A method of manufacturing a semiconductor device according to claim 1, wherein the C_4F_8 gas is cyclic and saturated fluorocarbon gas.

3. A method of manufacturing a semiconductor device according to claim 1, wherein the C_xF_y gas is C_5F_8 gas and said dry-etching step is performed under a condition of $0 < P_2/(P_1 + P_2) \leq 0.5$ where P_1 is a partial pressure of the C_4F_8 gas and P_2 is a partial pressure of the C_5F_8 gas.

4. A method of manufacturing a semiconductor device according to claim 1, wherein the insulating film is made of at least one insulating material selected from a group consisting of silicon oxide, phosphosilicate glass, borosilicate glass, borophosphosilicate glass, fluorosilicate glass, hydrogen silsesquioxane, tetraethylorthosilicate, carbon containing silicon oxide, and spin-on-glass.

5. A method of manufacturing a semiconductor device according to claim 1, wherein the etching gas further contains at least one gas selected from a group consisting of argon, oxygen and carbon monoxide.

6. A method of manufacturing a semiconductor device according to claim 1, further comprising, before said step of covering the surface of the insulating film with the mask pattern, a step of forming an etching stopper film on the surface of a semiconductor substrate and forming the insulating film on the etching stopper film, the etching stopper film being made of material having an etching rate slower than an etching rate of the insulating film when said dry-etching process is performed by using the etching gas under a same etching condition.

7. A method of manufacturing a semiconductor device, comprising the steps of:

preparing a semiconductor substrate having a metal wiring whose upper surface is exposed on a surface of the semiconductor substrate;

forming an etching stopper film made of a first insulating material on the surface of the semiconductor substrate;

depositing an insulating film on the etching stopper film, the insulating film being made of a second insulating material which contains Si and has an etching resistance different from the etching stopper film;

covering a surface of the insulating film with a resist pattern having an opening superposed upon the metal wiring;

dry-etching the insulating film by using the mask pattern as a mask and etching gas which contains C_4F_8 gas and C_xF_y gas (wherein x and y are an integer and satisfy $x \geq 5$ and $y \leq (2x - 1)$, to form a recess and expose the etching stopper film on a bottom of the recess;

removing the resist pattern under a condition that the metal wiring is covered with the etching stopper film;

removing the etching stopper film exposed at said dry-etching step to expose a part of the metal wiring; and

burying conductive material in the recess etched by said dry-etching step to form a conductive member connected to the metal wiring,

wherein an etching rate of the first insulating material is slower than an etching rate of the second insulating material when said dry-etching step is performed by the etching gas.

8. A method of manufacturing a semiconductor device according to claim 7, wherein the C_4F_8 gas is cyclic and saturated fluorocarbon gas.

9. A method of manufacturing a semiconductor device according to claim 7, wherein the C_xF_y gas is C_5F_8 gas and said dry-etching step is performed under a condition of $0 < P_2/(P_1 + P_2) \leq 0.5$ where P_1 is a partial pressure of the C_4F_8 gas and P_2 is a partial pressure of the C_5F_8 gas.

10. A method of manufacturing a semiconductor device according to claim 7, wherein the insulating film is made of at least one insulating material selected from a group consisting of silicon oxide, phosphosilicate glass, borosilicate glass, borophosphosilicate glass, fluorosilicate glass, hydrogen silsesquioxane, tetraethylorthosilicate, carbon containing silicon oxide, and spin-on-glass.

11. A method of manufacturing a semiconductor device, comprising the steps of:

forming a first film of SiN or SiC on an underlying layer formed with a copper wiring, a copper plug or a tungsten plug in a surface layer of the

underlying layer;

forming a second film made of insulating material on the first film;

covering the second film with a mask pattern, and

dry-etching the second film by using the mask pattern as a mask and etching gas which contains C_4F_8 gas and C_xF_y gas (wherein x and y are an integer and satisfy $x \geq 5$ and $y \leq (2x - 1)$.

12. A method of manufacturing a semiconductor device according to claim 11, wherein the C_4F_8 gas is cyclic and saturated fluorocarbon gas.

13. A method of manufacturing a semiconductor device according to claim 11, wherein the C_xF_y gas is C_5F_8 gas and said dry-etching step is performed under a condition of $0 < P_2/(P_1 + P_2) \leq 0.5$ where P_1 is a partial pressure of the C_4F_8 gas and P_2 is a partial pressure of the C_5F_8 gas.

14. A method of manufacturing a semiconductor device according to claim 11, wherein the second film is made of at least one insulating material selected from a group consisting of silicon oxide, phosphosilicate glass, borosilicate glass, borophosphosilicate glass, fluorosilicate glass, hydrogen silsesquioxane, tetraethylorthosilicate, carbon containing silicon oxide, and spin-on-glass.

15. A method of manufacturing a semiconductor device according to claim 11, wherein the etching gas further contains at least one gas selected from a group consisting of argon, oxygen and carbon monoxide.